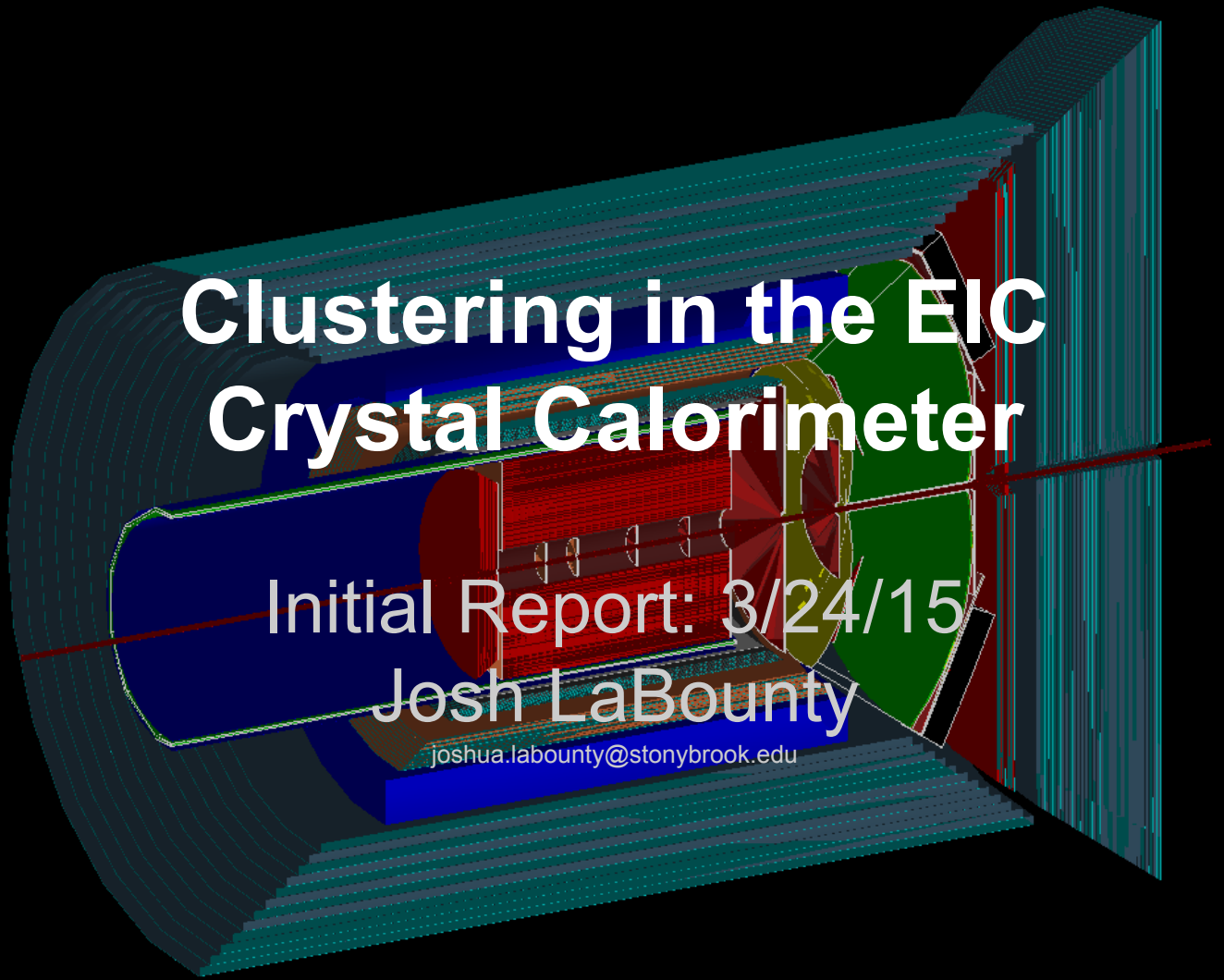
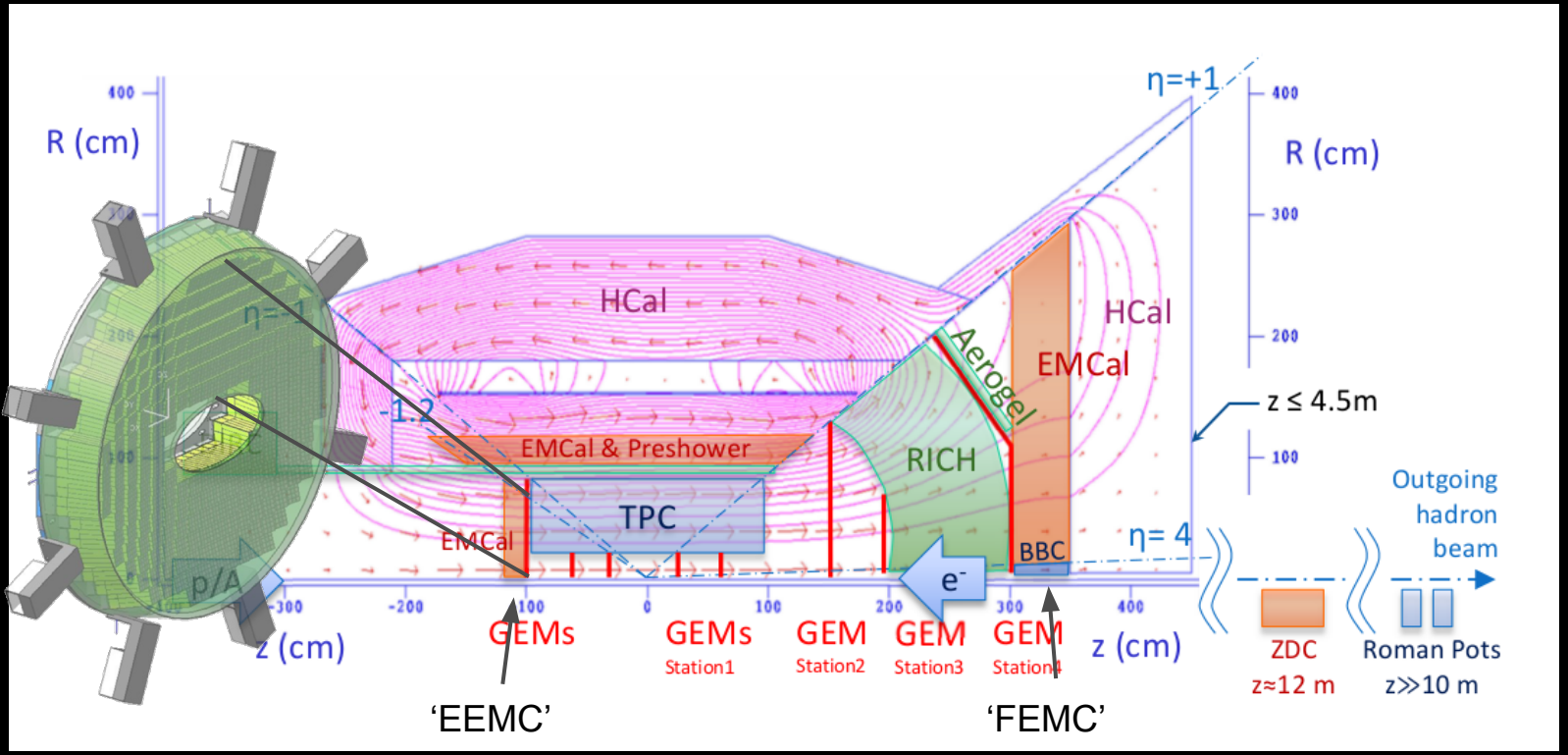


Clustering in the EIC Crystal Calorimeter

Initial Report: 3/24/15

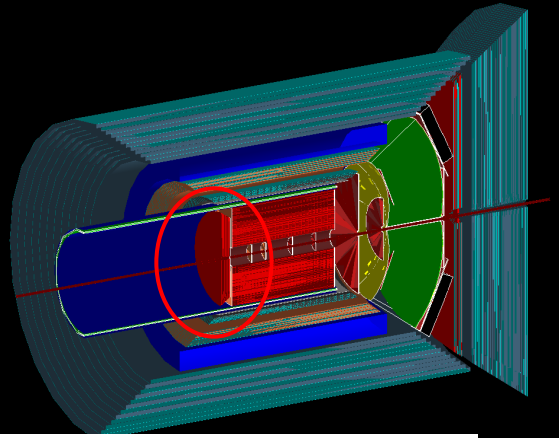
Josh LaBounty
joshua.labounty@stonybrook.edu

EIC: Location and Design

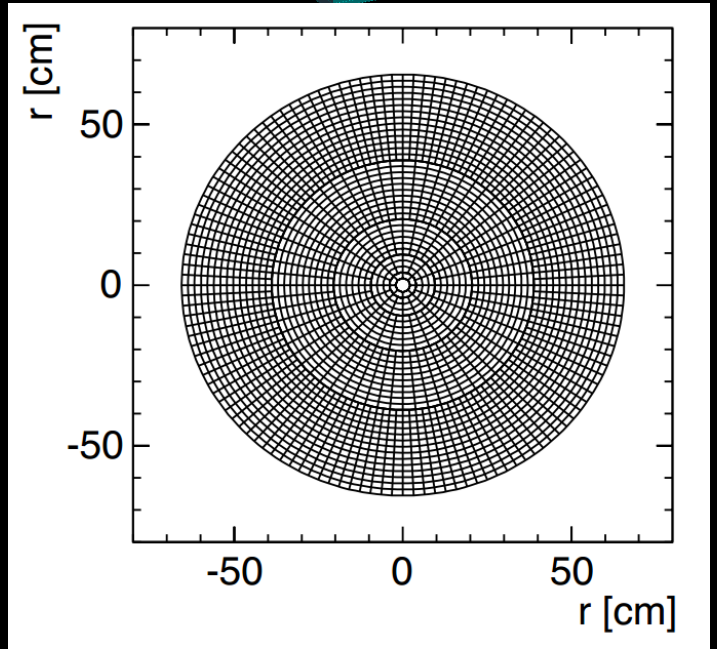


arXiv:1402.1209v1 -- Figure 3.1, 3.5

EIC: Location and Design

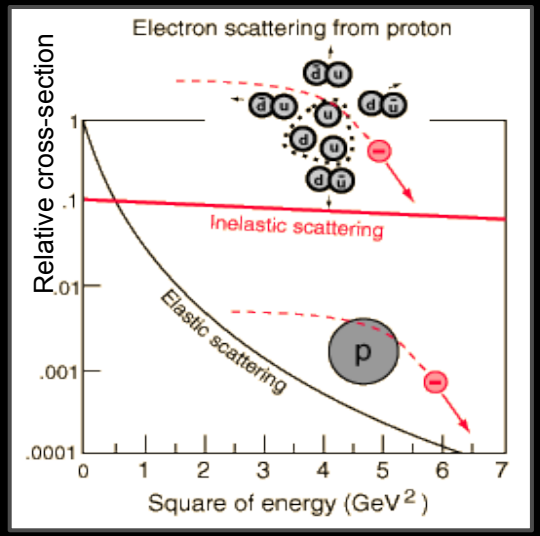


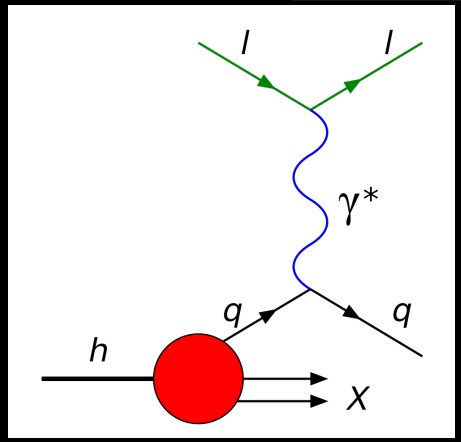
- Current implementation is simplified
  - Starting z-position: -99.0 cm
  - Thickness: 18 cm
  - Material: $PbWO_4$
- Currently split into 5 sections via RawTowerBuilderCone() depending on ‘η’
  - $-1.2 \leq \eta \leq -4.5$



EIC: Location and Design

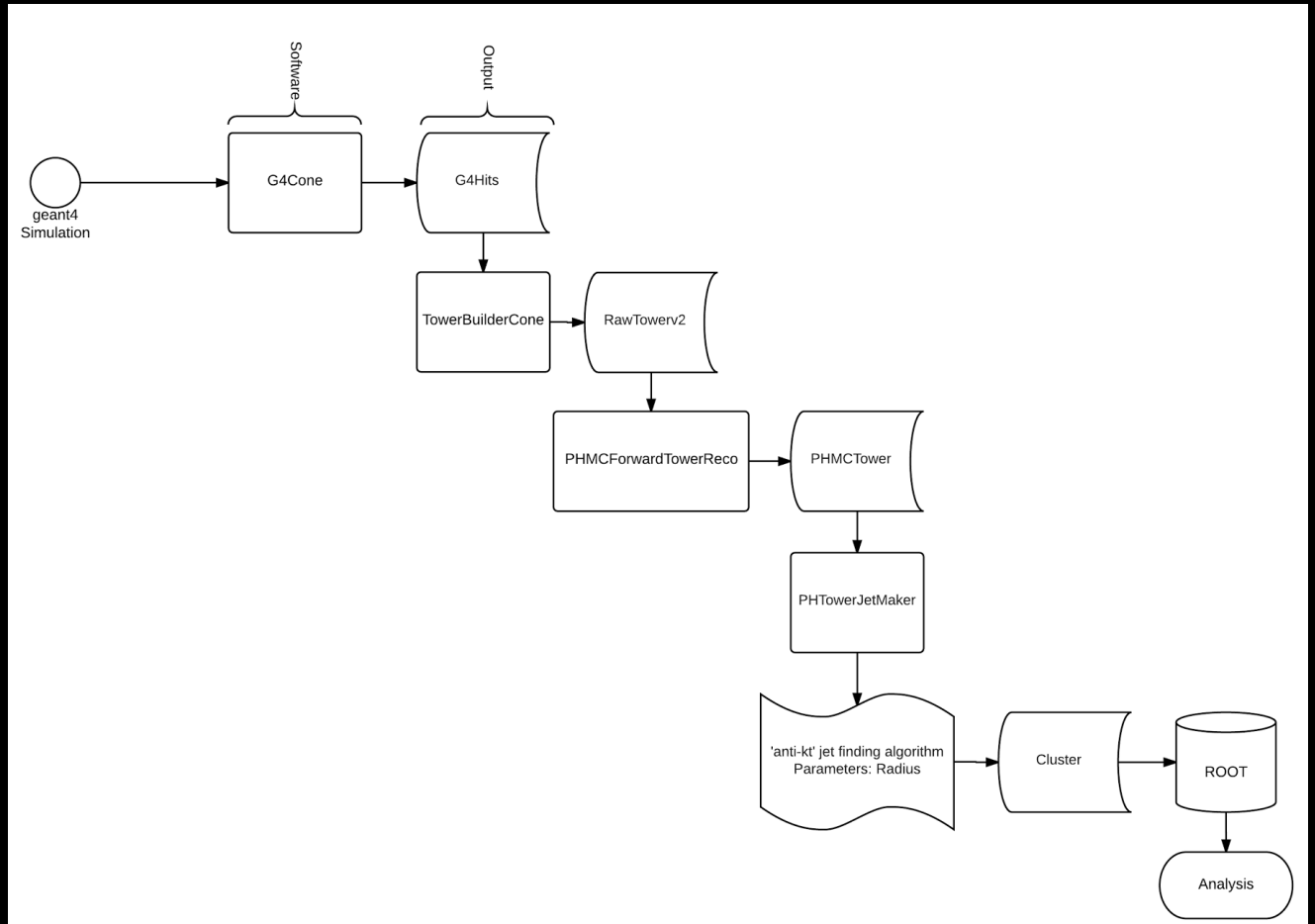
- Main purpose: Identify electrons and measure electron energy and angle for Deep Inelastic Scattering measurements.



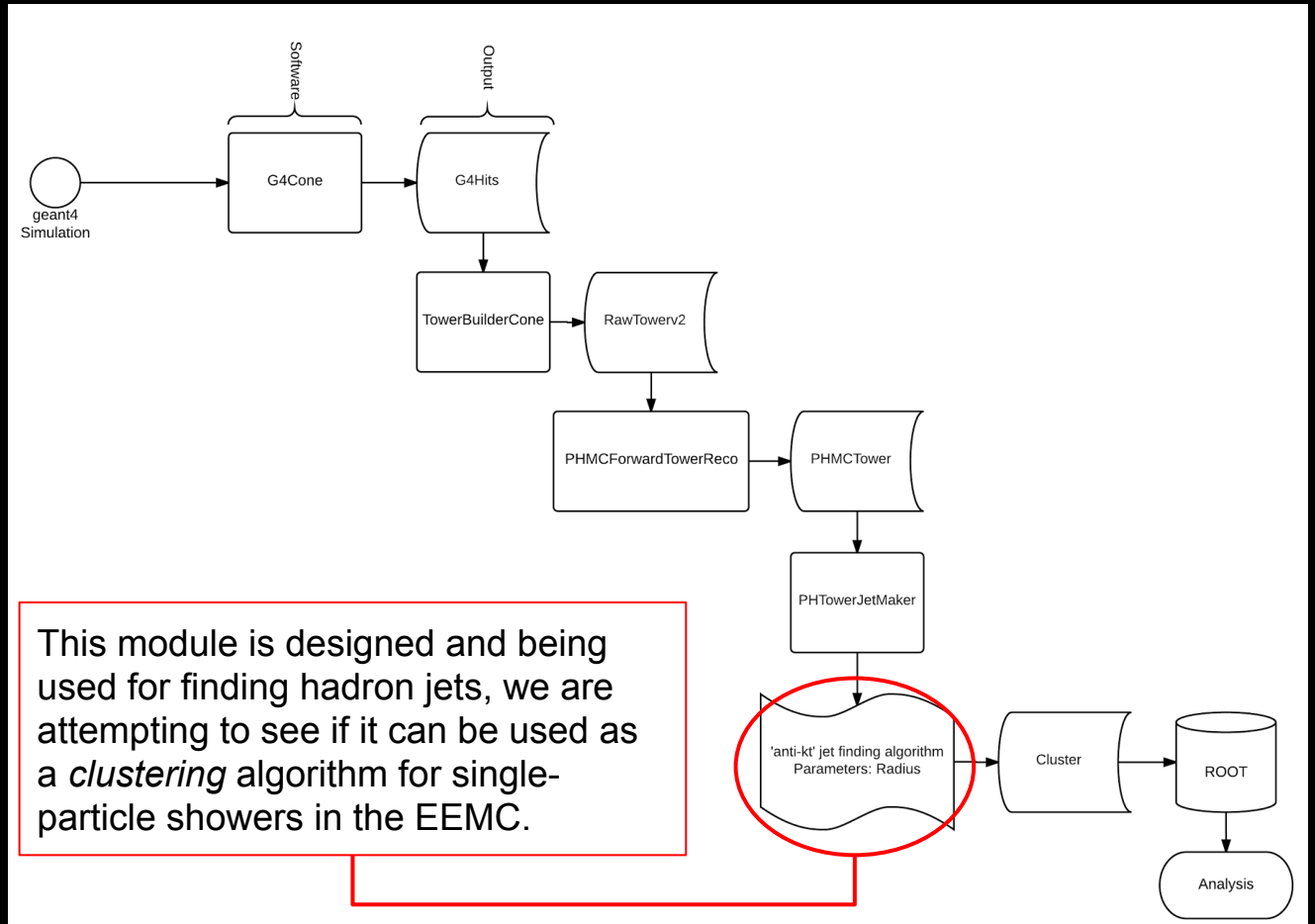


HyperPhysics and Wikimedia

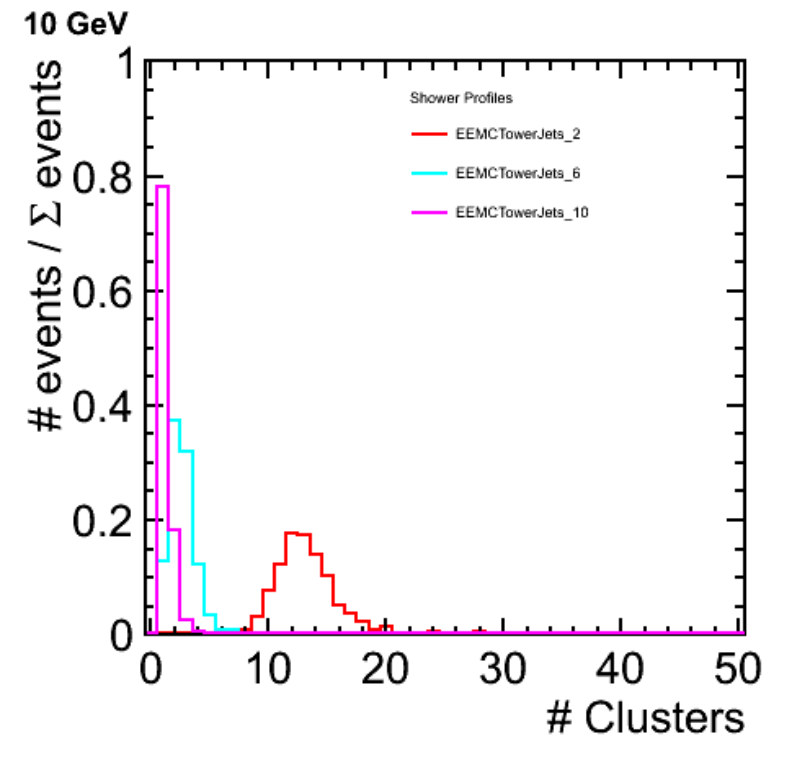
Software Flow



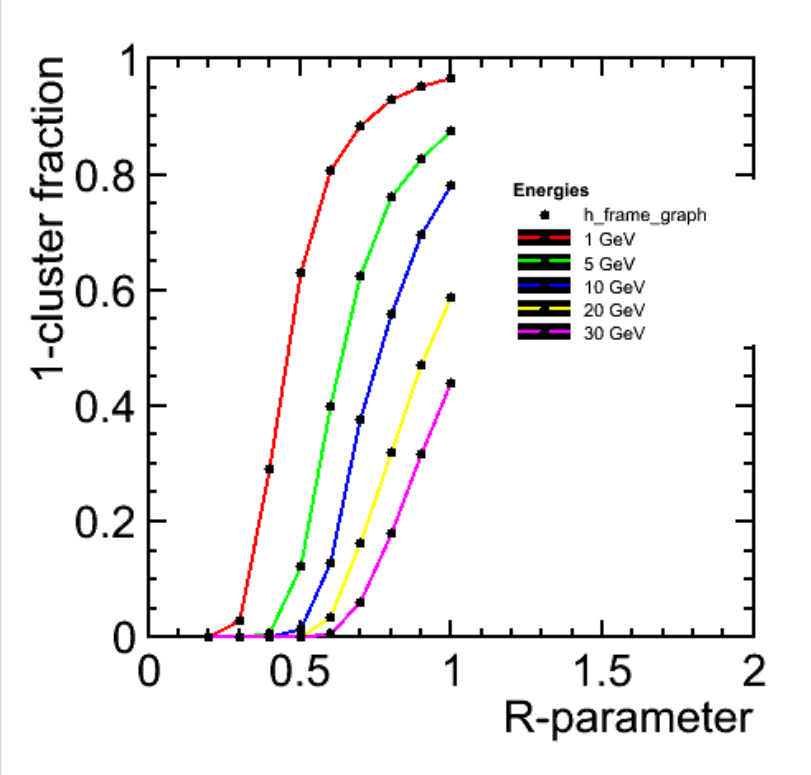
Software Flow



Cluster Calculation

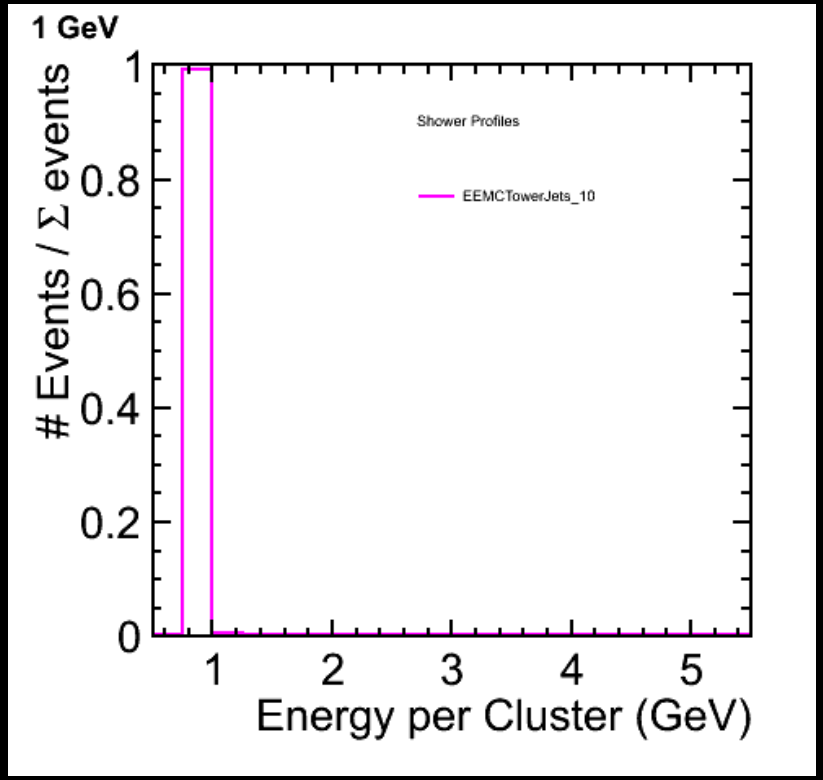


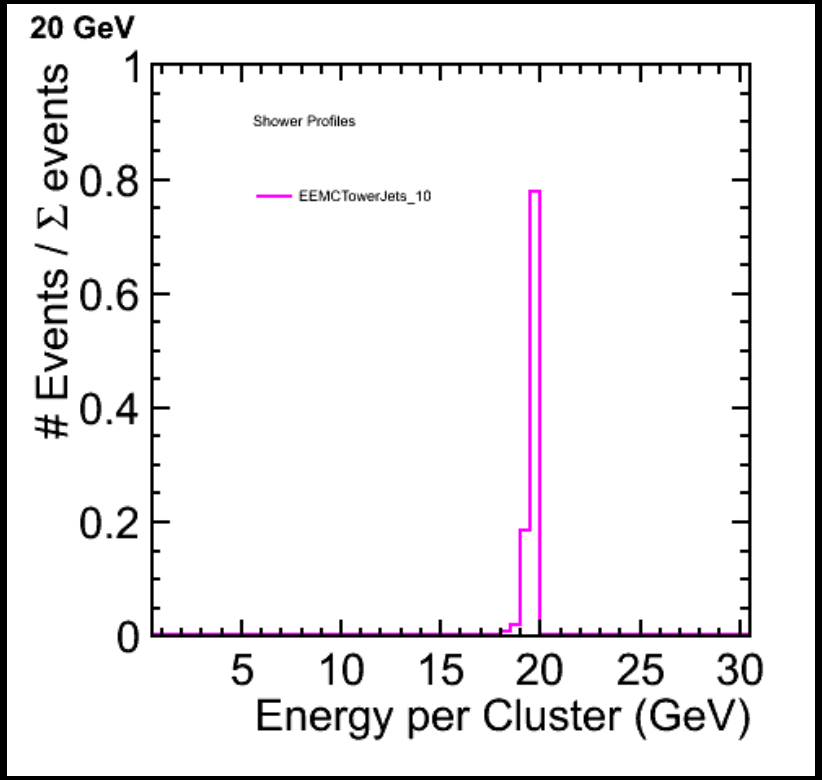
Number of clusters determined by the algorithm for 3 different R-parameters



Fraction of events with exactly 1 cluster as function of radius parameter

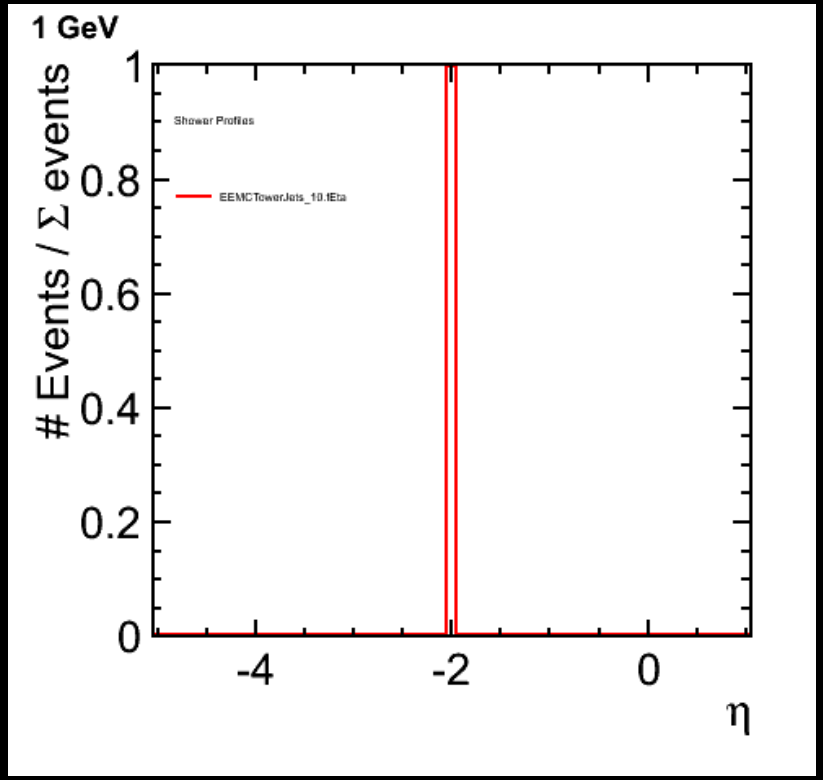
Energy per Cluster

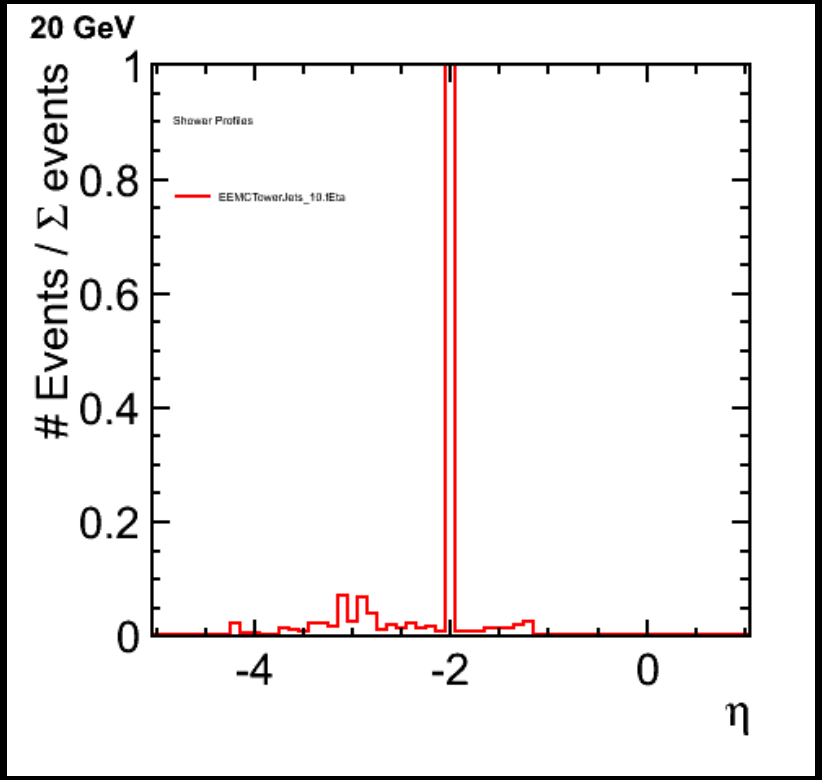




Example histograms of measured cluster energy -- Normalized

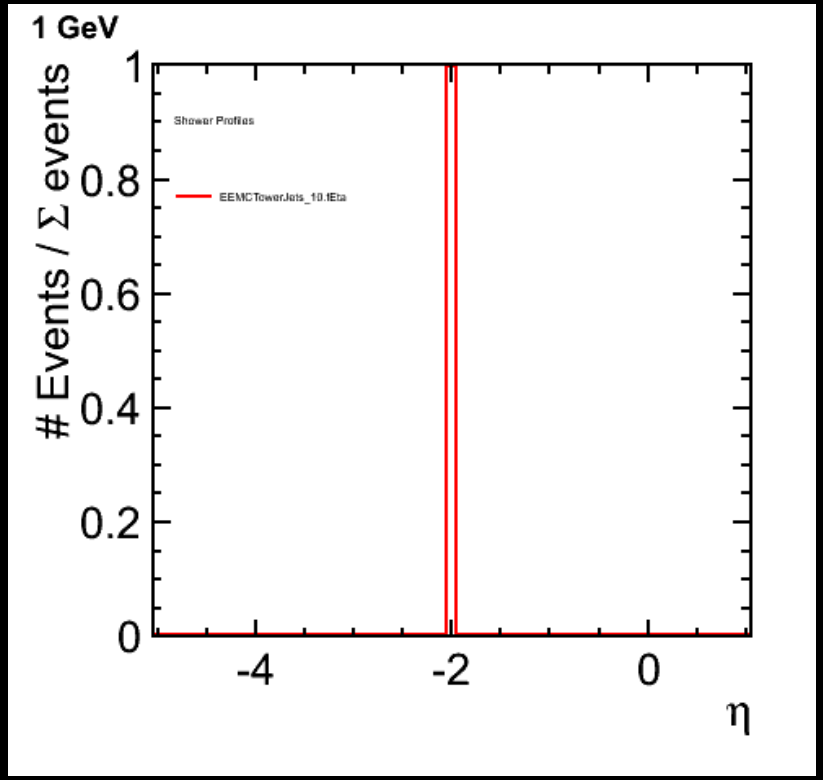
Eta of the Calculated Clusters

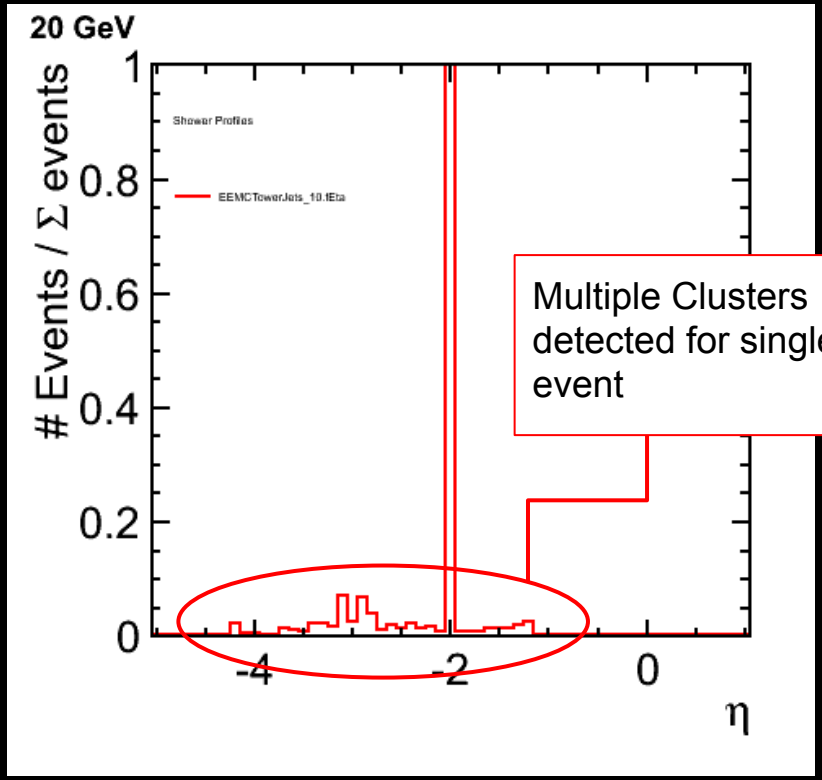




Example histograms of measured cluster η.

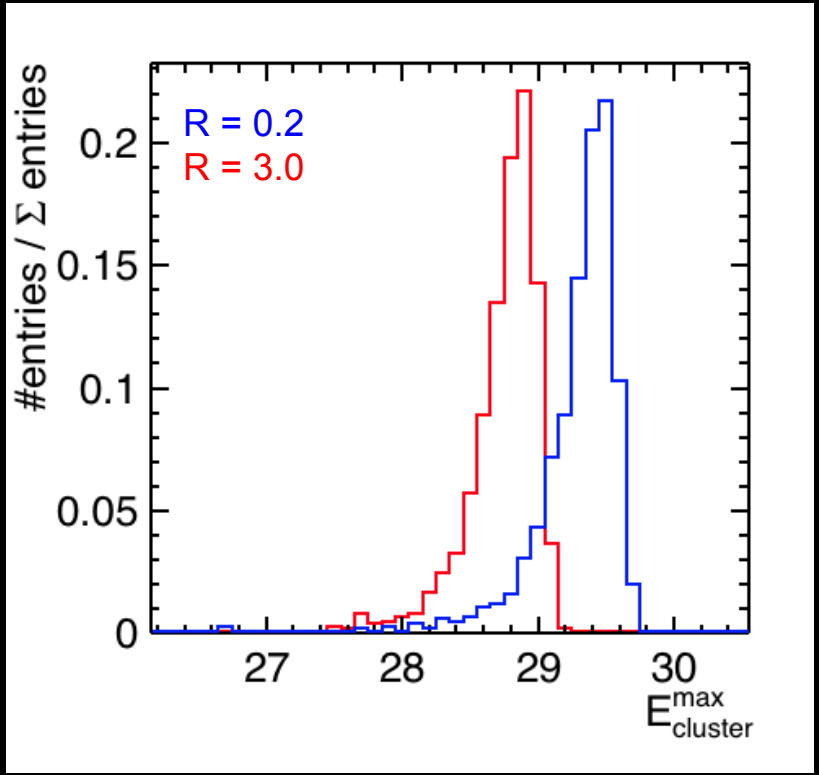
Eta of the Calculated Clusters

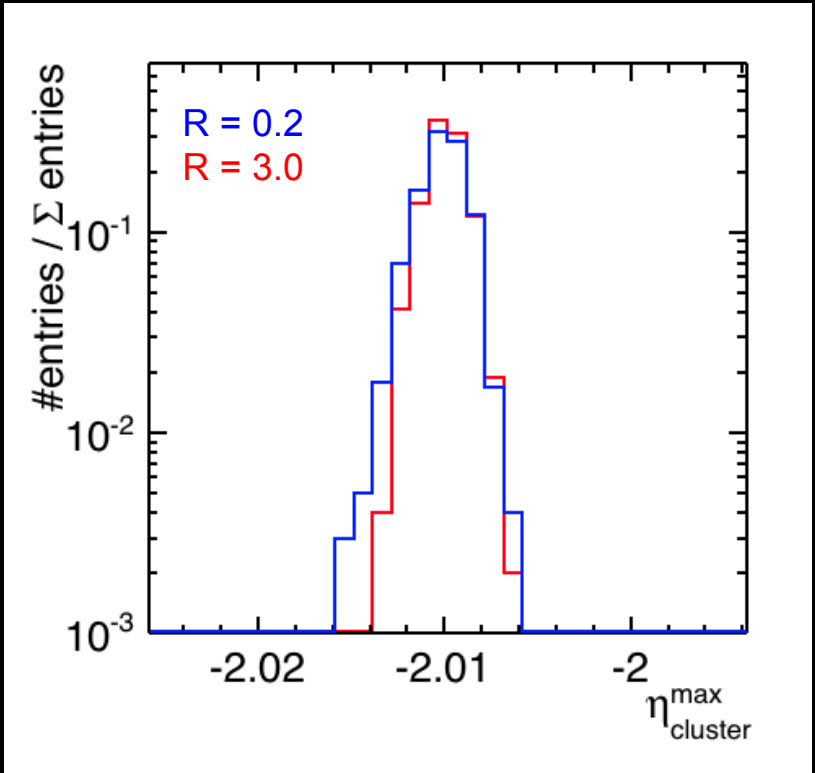




Example histograms of measured cluster η.

30 GeV





Energy and η for those clusters with maximum energy

Summary

- ‘anti-kt’ algorithm seems promising for single particle showers
- Need to do additional studies to see if it will scale to true Deep Inelastic Scattering events

Extra Slides

EIC: Location and Design

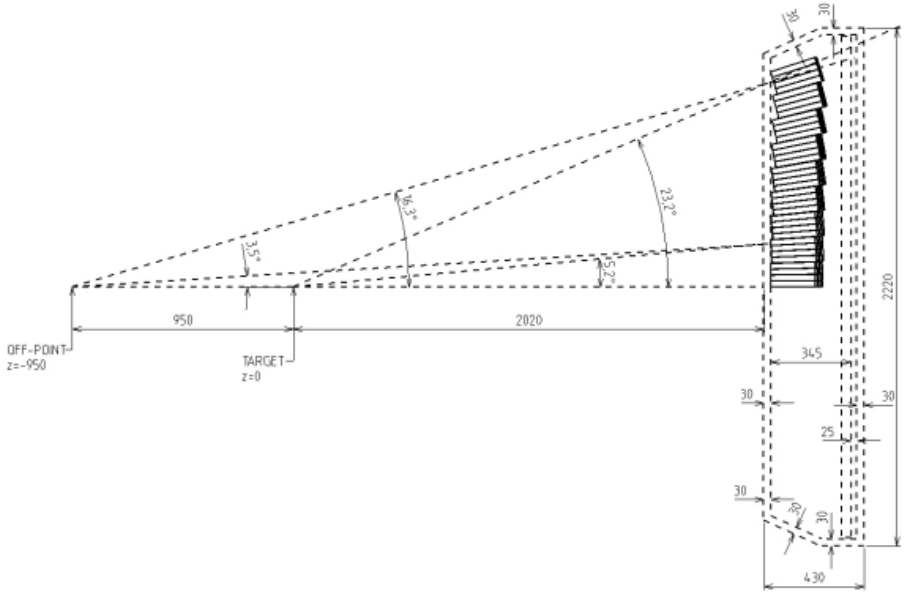
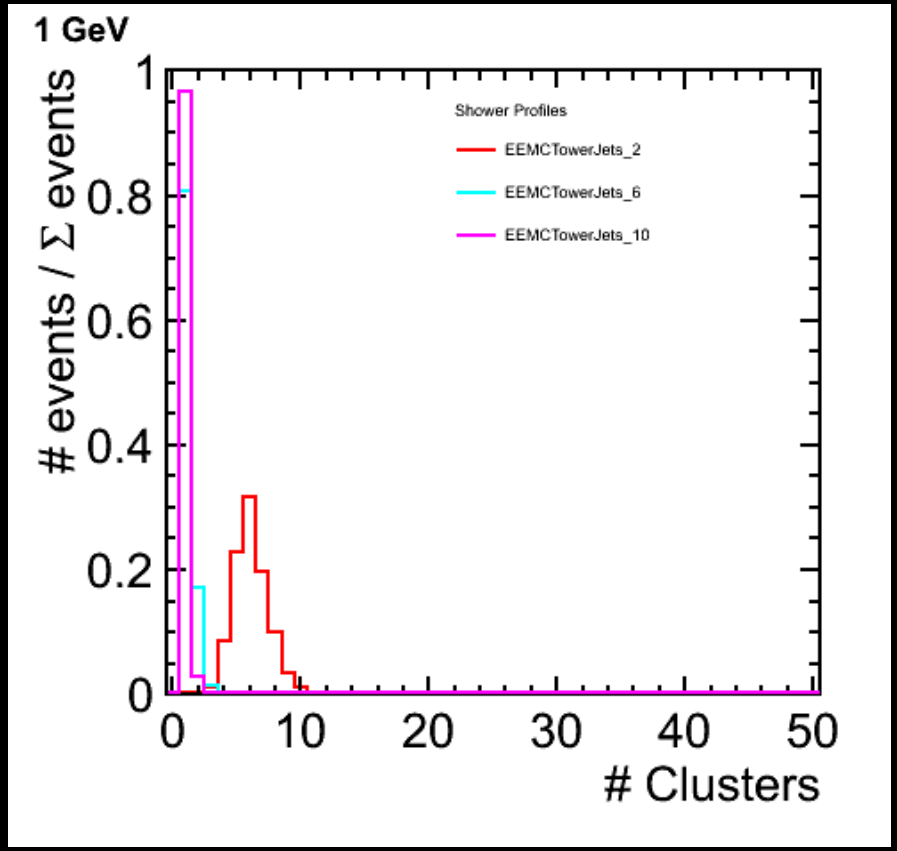


Figure 7.23: The position of the forward endcap EMC with respect to the target.

EEMC crystals are projective towards target, Focused at a point off center from interaction point

arXiv:0810.1216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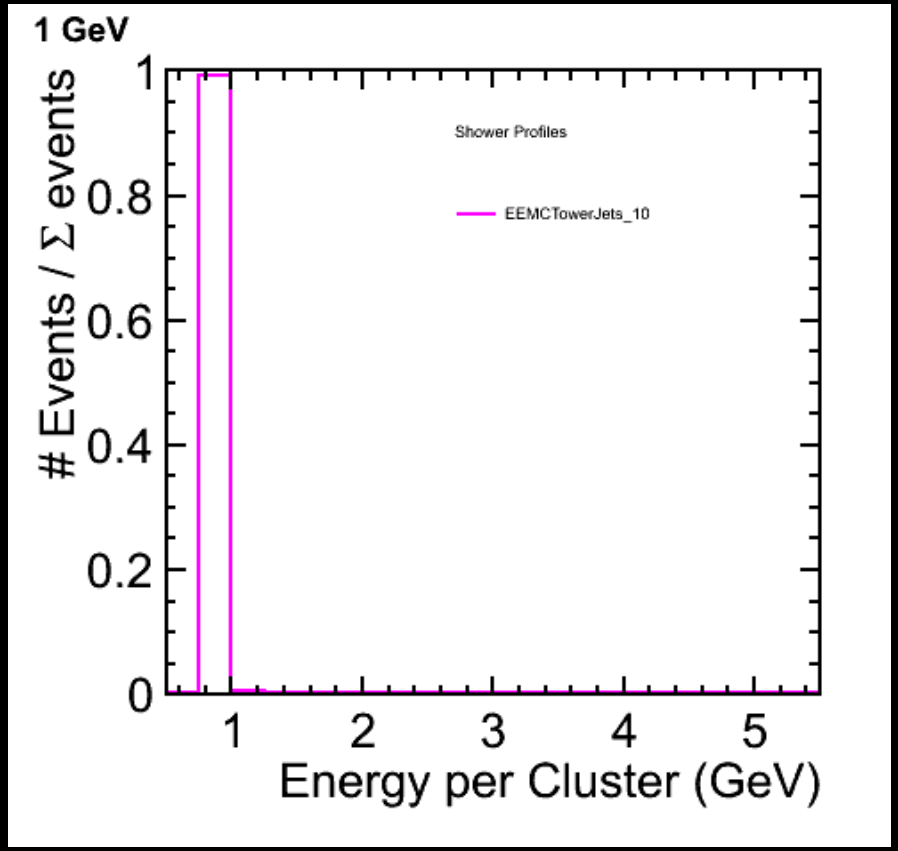
events / Σ events
Clusters
Shower Profiles
EEMCTowerJets_2
EEMCTowerJets_6
EEMCTowerJets_10
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50


1 GeV
Events / Σ events
Energy per Cluster (GeV)
Shower Profiles
EEMCTowerJets_10
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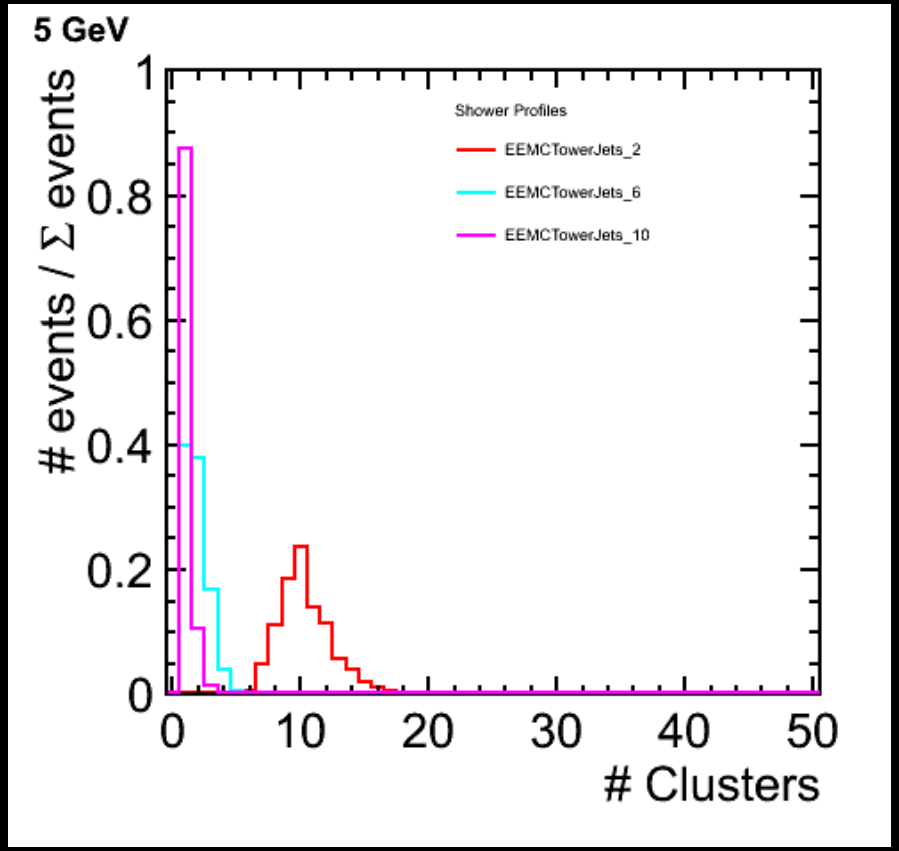
0.2
0.4
0.6
0.8
1
1
2
3
4
5


5 GeV
events / Σ events
Clusters
Shower Profiles
EEMCTowerJets_2
EEMCTowerJets_6
EEMCTowerJets_10
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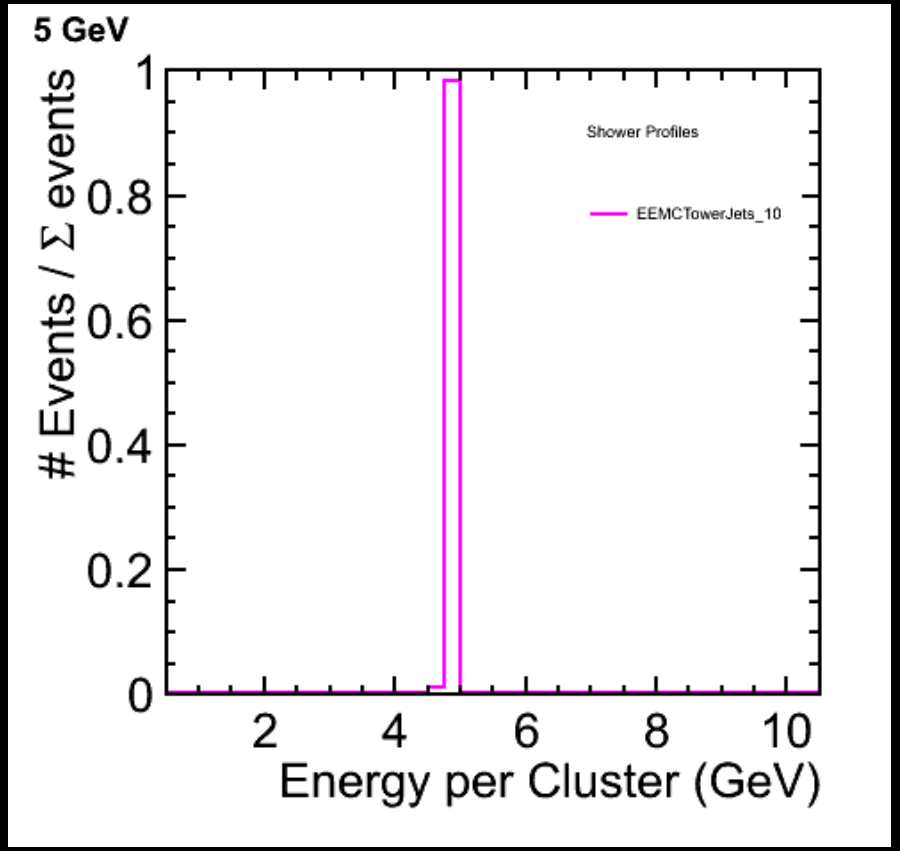
0.4
0.6
0.8
1
0
10
20
30
40
50


5 GeV
Events / Σ events
Energy per Cluster (GeV)
Shower Profiles
EEMCTowerJets_10
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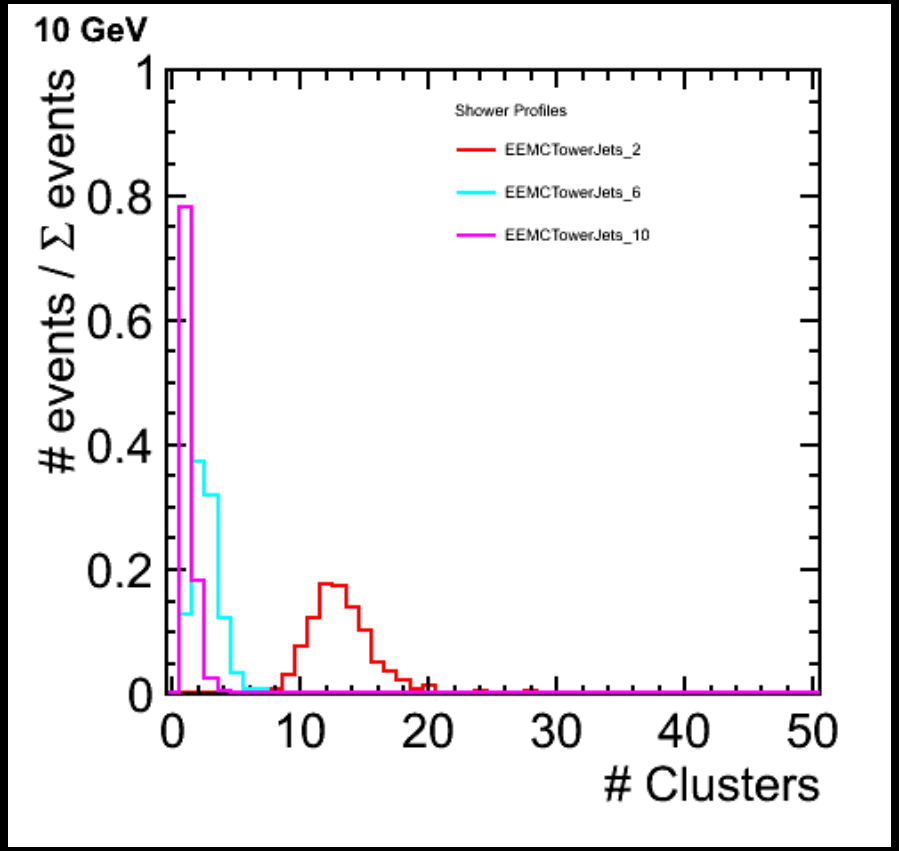
0.2
0.4
0.6
0.8
1
2
4
6
8
10


10 GeV
events / Σ events
Clusters
Shower Profiles
EEMCTowerJets_2
EEMCTowerJets_6
EEMCTowerJets_10
0
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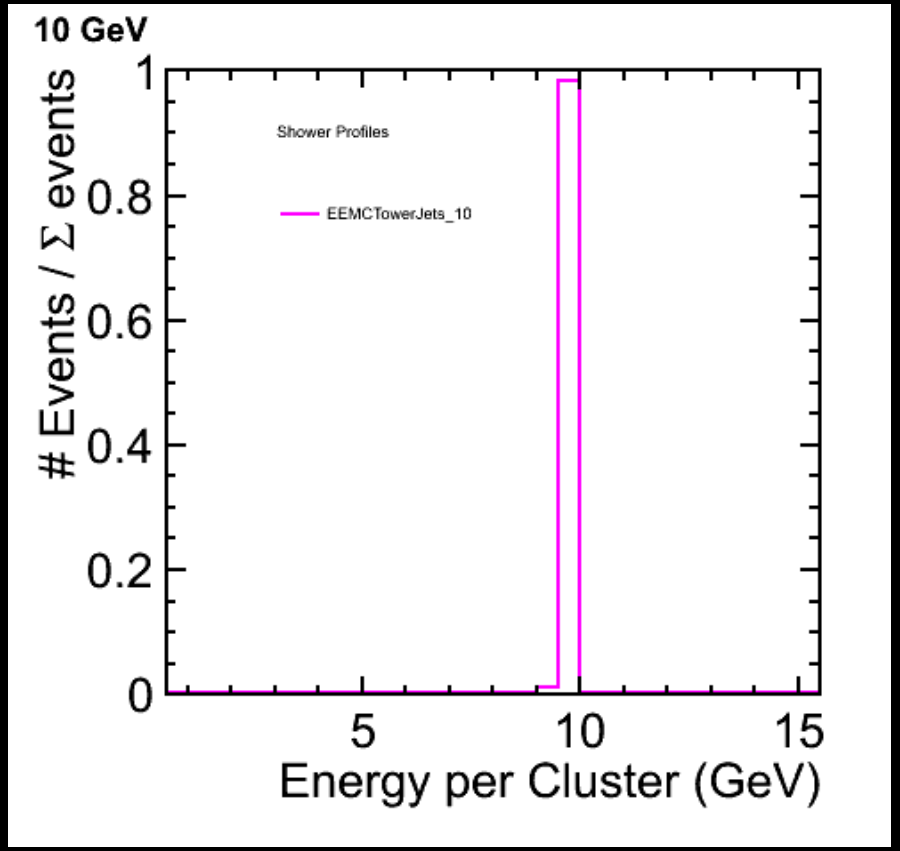
0.4
0.6
0.8
1
0
10
20
30
40
50


10 GeV
Events / Σ events
Energy per Cluster (GeV)
Shower Profiles
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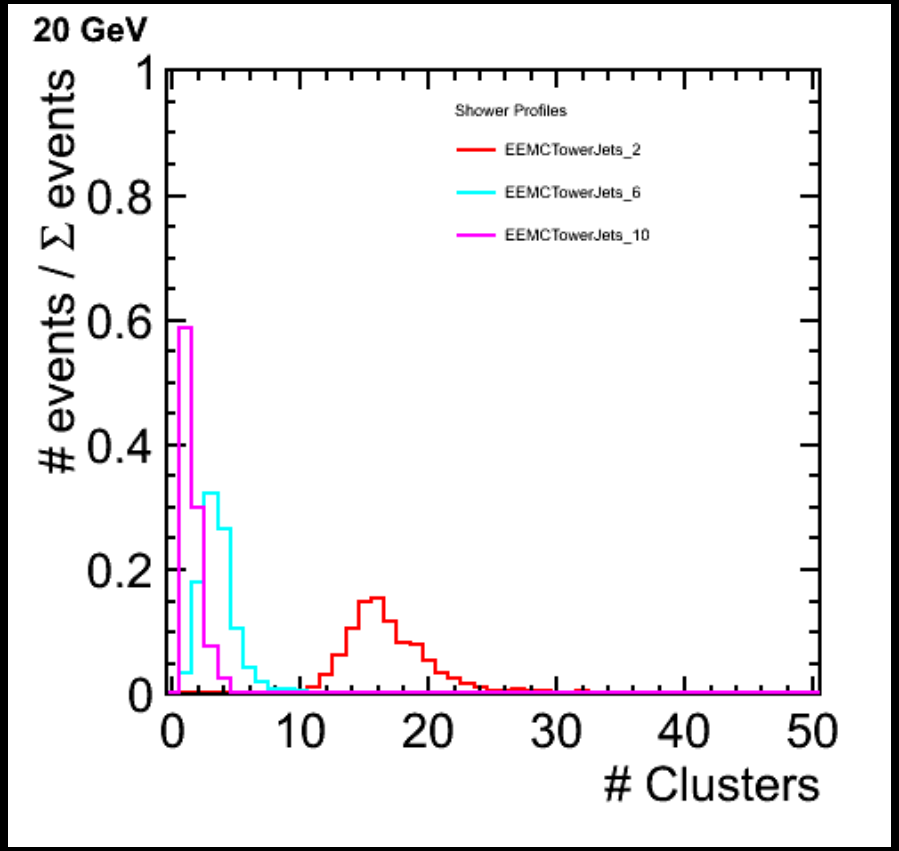
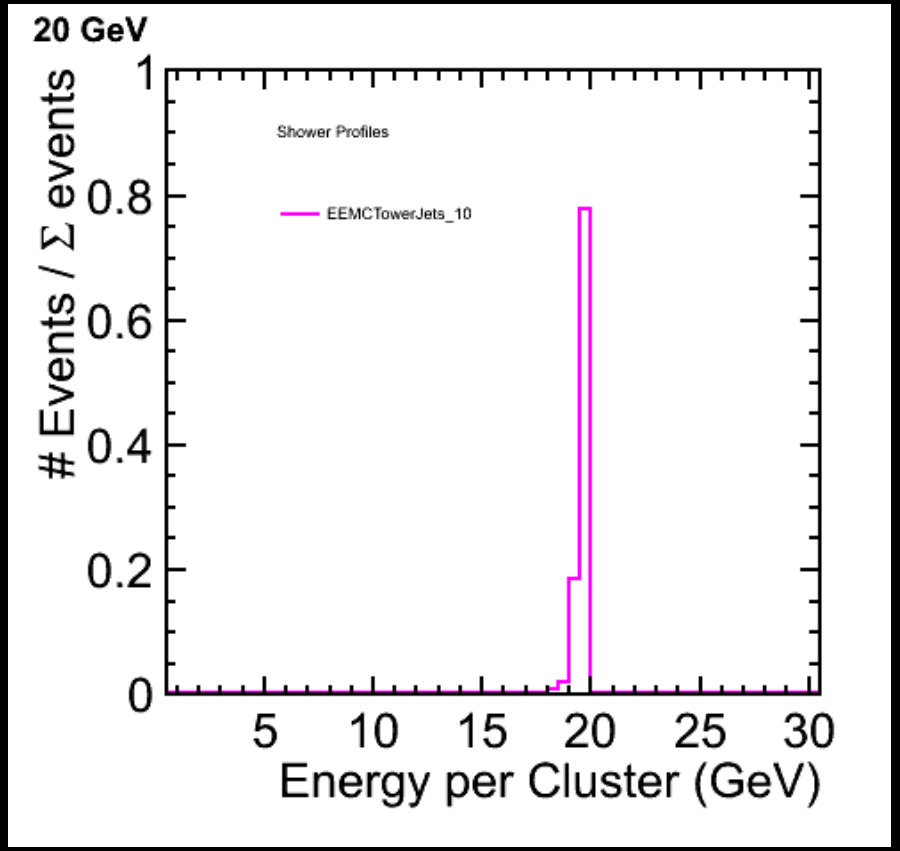
0.2
0.4
0.6
0.8
1
5
10
15


20 GeV
Shower Profiles
EEMCTowerJets_2
EEMCTowerJets_6
EEMCTowerJets_10
events / Σ events
Clusters
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50


20 GeV
Shower Profiles
EEMCTowerJets_10
Events / Σ events
Energy per Cluster (GeV)
0
0.2
0.4
0.6
0.8
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5
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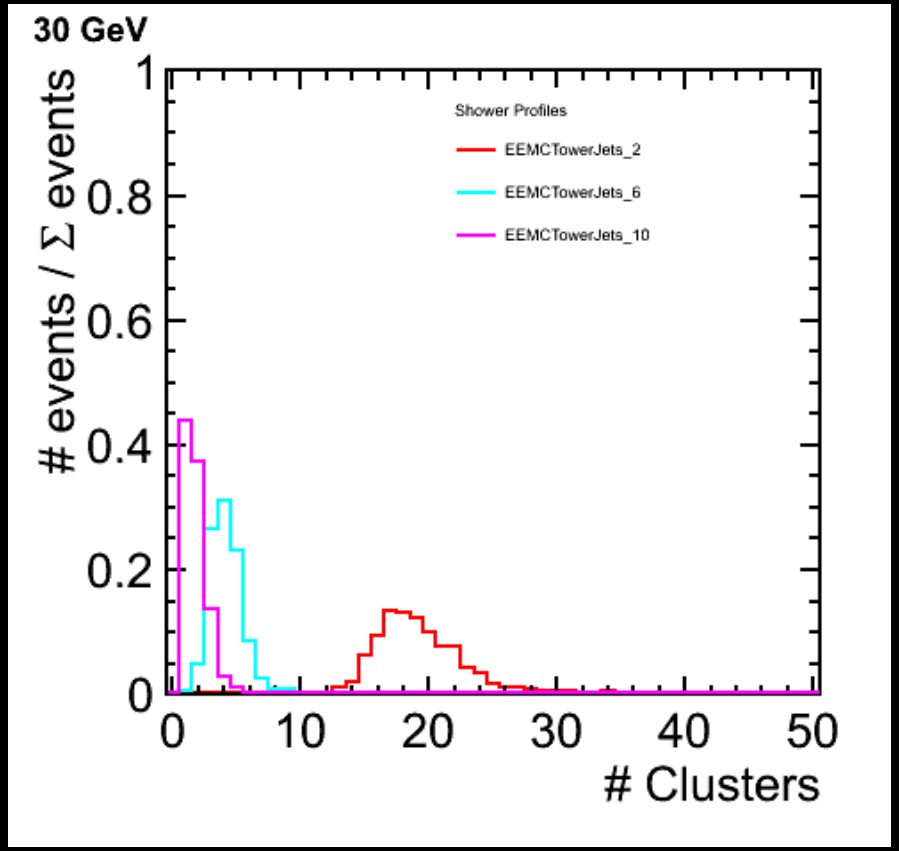
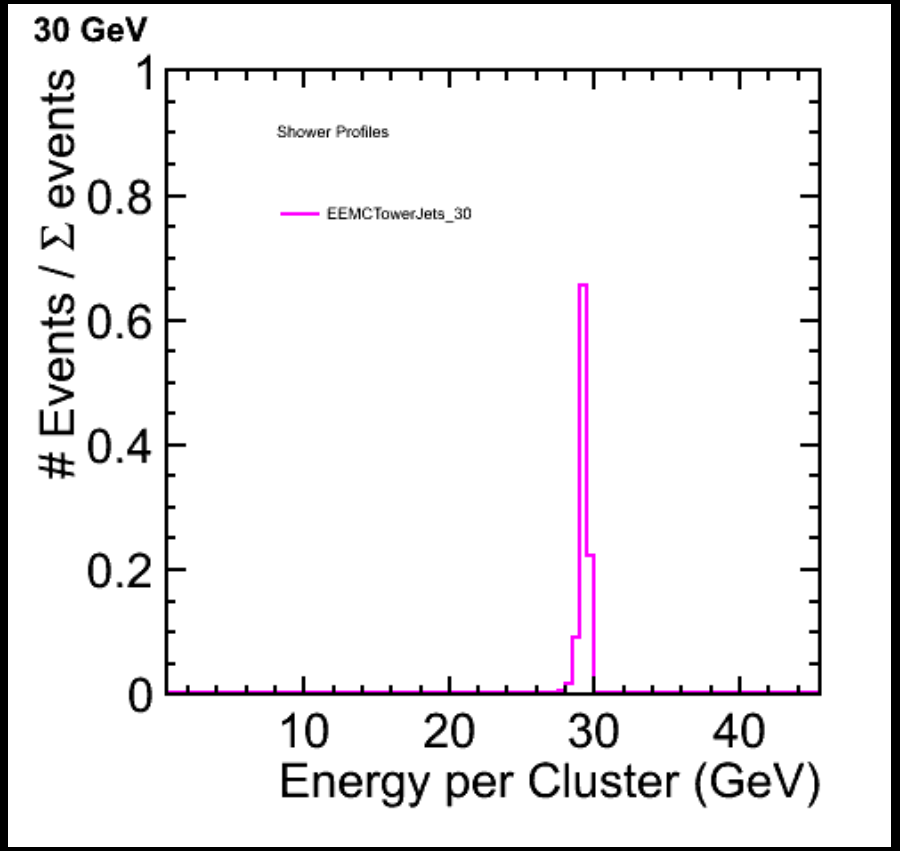
15
20
25
30


30 GeV
events / Σ events
Clusters
Shower Profiles
EEMCTowerJets_2
EEMCTowerJets_6
EEMCTowerJets_10
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50


30 GeV
Events / Σ events
Energy per Cluster (GeV)
Shower Profiles
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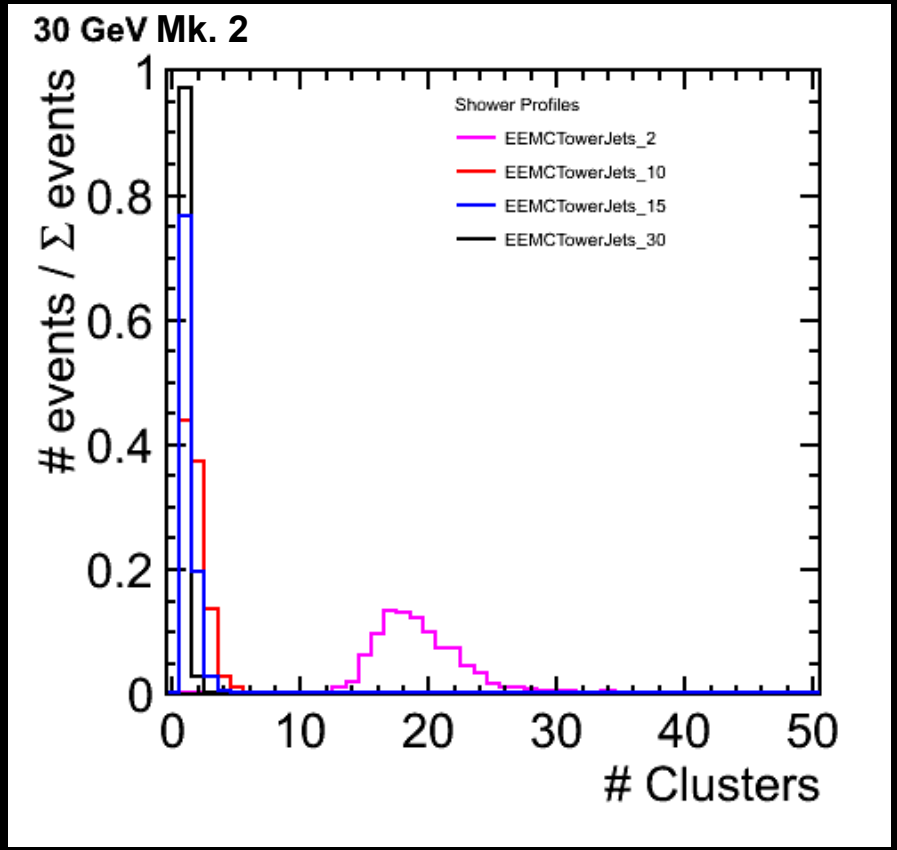
0.6
0.8
1
10
20
30
40


30 GeV Mk. 2
Shower Profiles
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EEMCTowerJets_10
EEMCTowerJets_15
EEMCTowerJets_30
events / Σ events
Clusters
0
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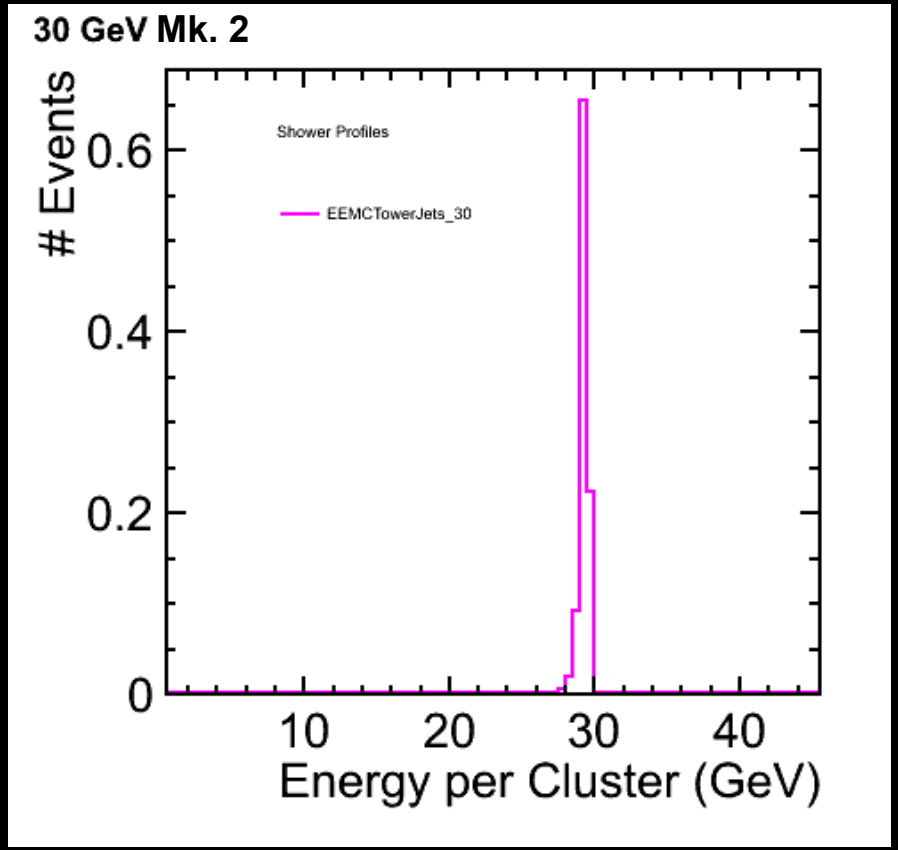
0.4
0.6
0.8
1
0
10
20
30
40
50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Events
Energy per Cluster (GeV)
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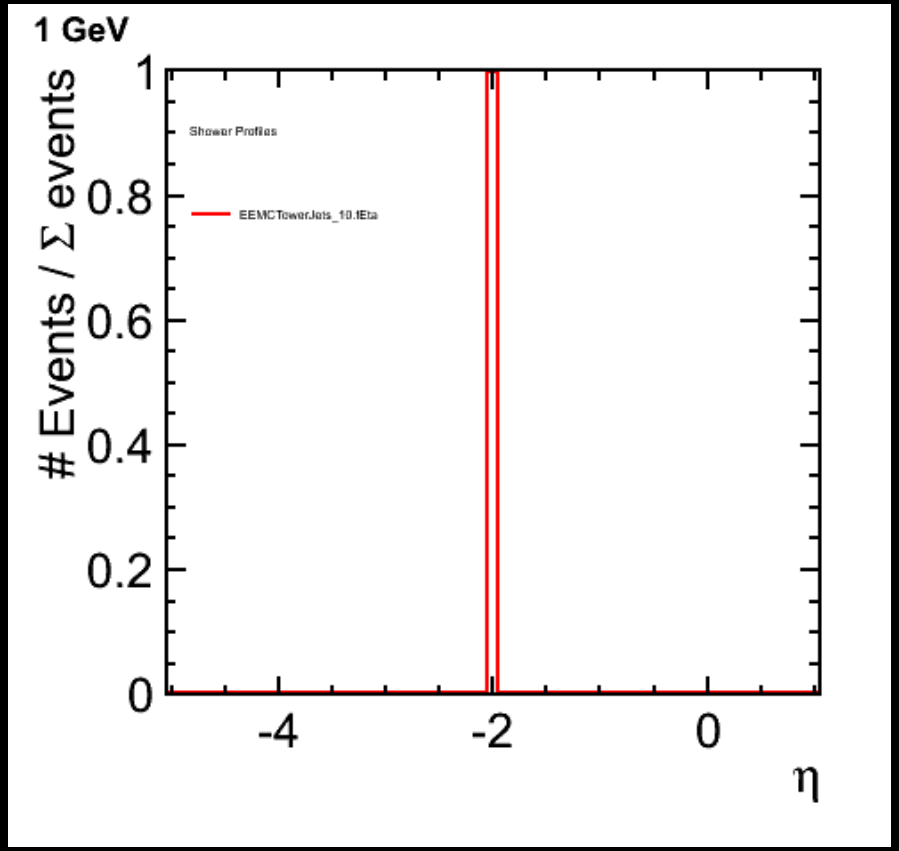
0.6
10
20
30
40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Shower Profiles
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Events / Σ events
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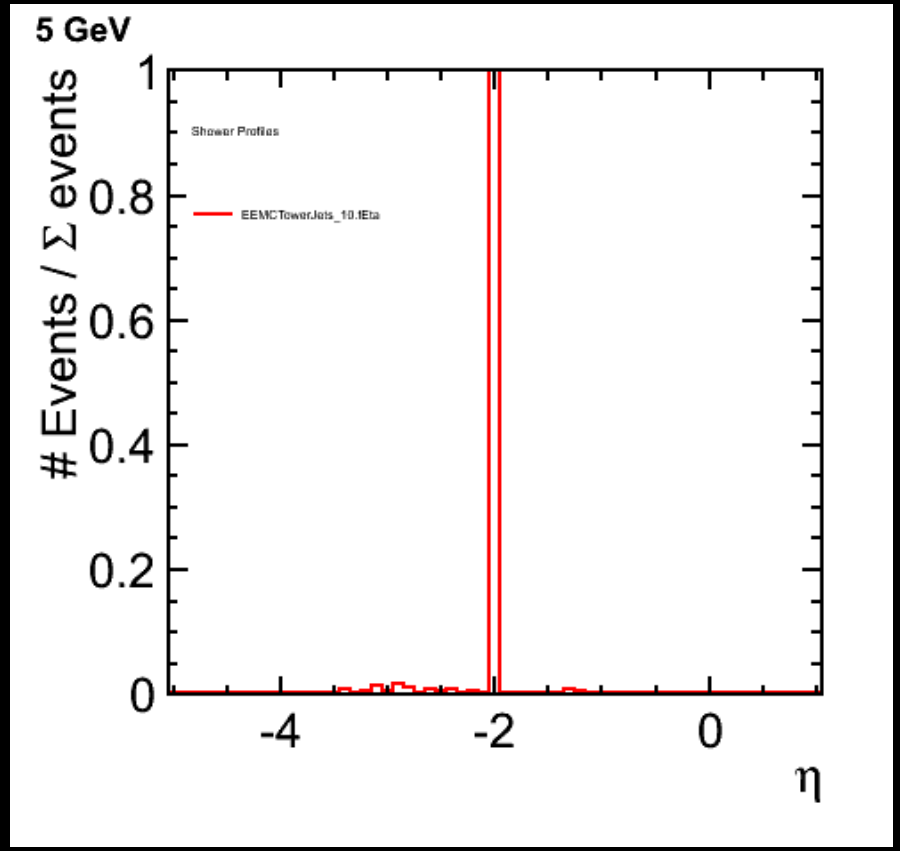
0.6
0.4
0.2
0
-4
-2
0
η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Shower Profiles
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Events / Σ events
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0.8
0.6
0.4
0.2
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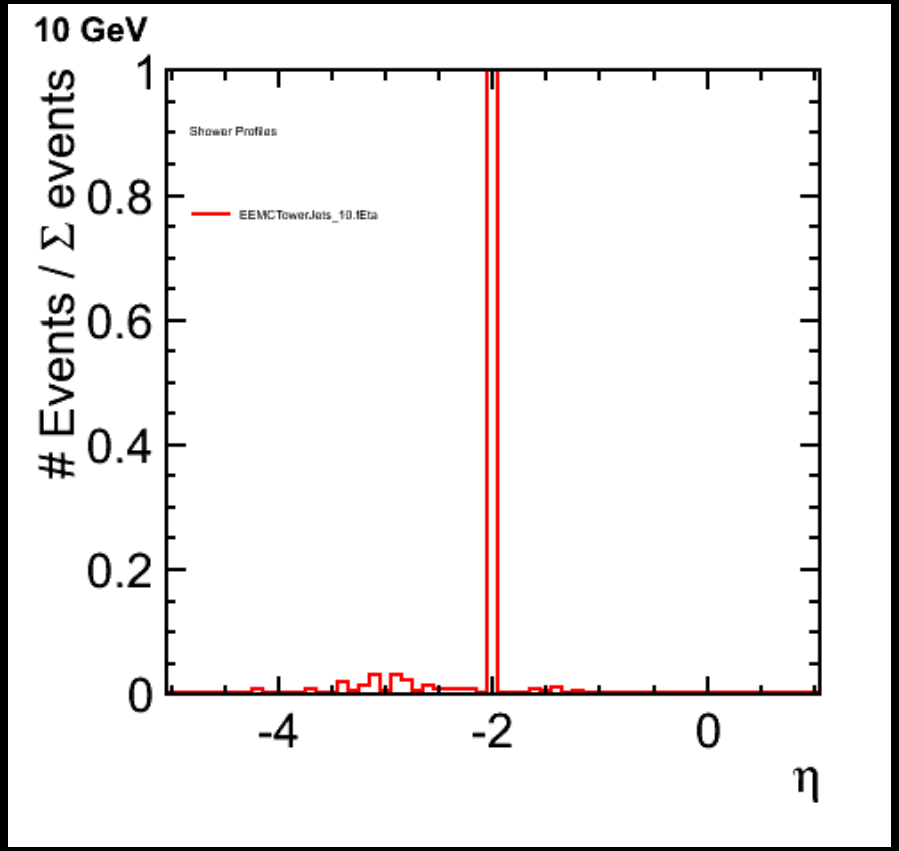
-4
-2
0
η


10 GeV
Shower Profiles
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Events / Σ events
1
0.8
0.6
0.4
0.2
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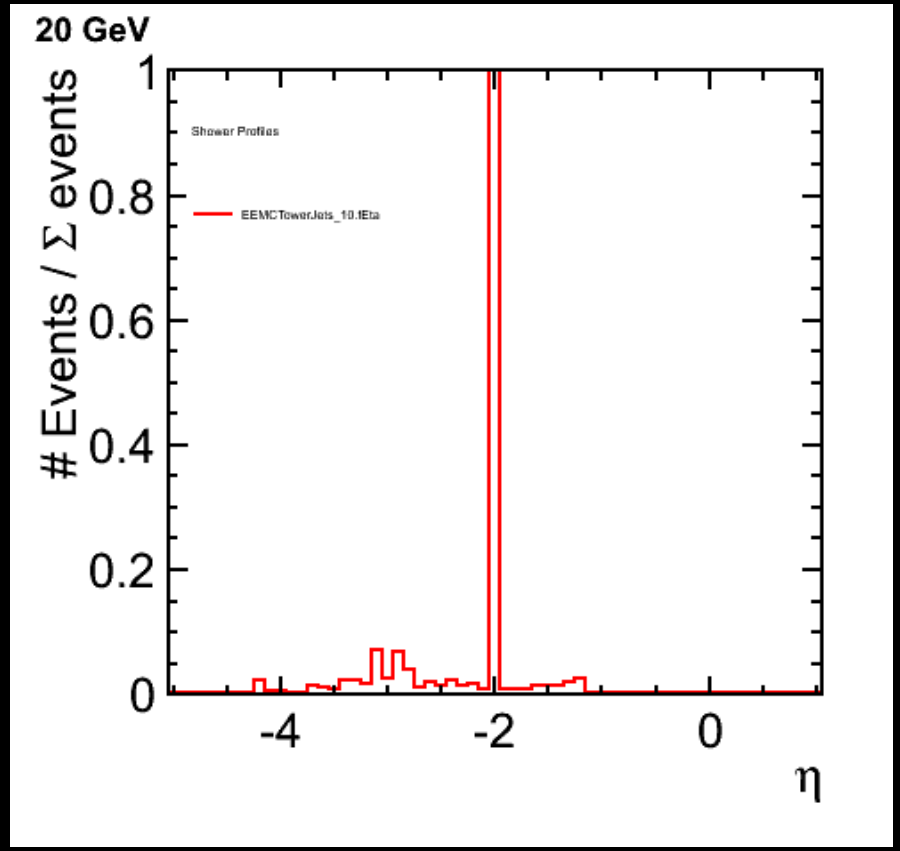
-4
-2
0
η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Events / Σ events
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0.6
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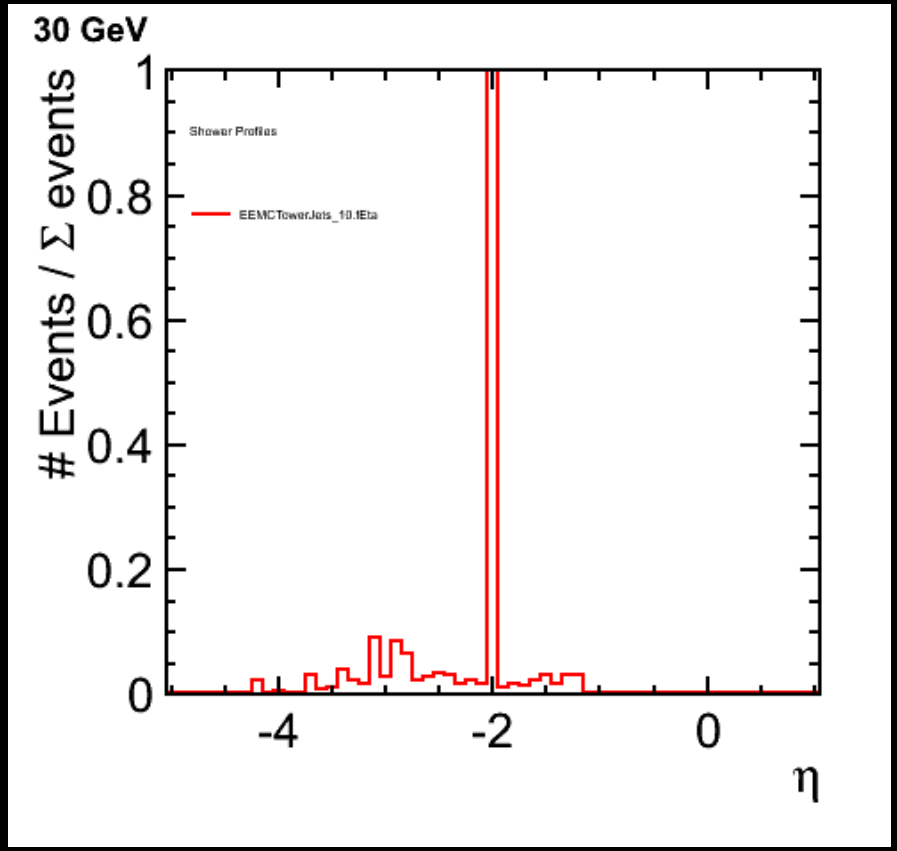
-2
0
η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EEMCTowerJets_10.fEta
Events / Σ events
1
0.8
0.6
0.4
0.2
0
-4
-2
0
η